

EFFECT OF ANIMAL AGE AND SEX ON
CERTAIN QUALITIES OF REINDEER MEAT

by
D.M. BLAYLOCK
D. A. CRAMER
and
L. E. WOOKEY
and

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DEPARTMENT OF ANIMAL SCIENCE
COLORADO STATE UNIVERSITY
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Efforts are being made to increase the reindeer industry in Alaska. This is the first of what we hope will be several scientific studies of the qualities and uses of reindeer meat and other by-products.

Knowledge of the reindeer meat characteristics and how they respond to different methods of handling and processing is essential in the production and distribution of acceptable products. It is also required to develop quality standards.

PROCEDURES

Animals were selected at random from the Nunivak Island slaughter, August 16 and 18, 1966. Sex and live weights were recorded and the animals were slaughtered by methods established in 1945. Ages were estimated by teeth emergence and wear, and colored tags placed in the ear as fawns.

Fat cover was measured to the nearest one-tenth inch over the ribeye between the 12th and 13th rib, perpendicular to the outside surface three-fourths of the length of the ribeye from the chine bone end. Carcasses were selected from 4-month old males; 16-month old males, steers, and females; 40-month old males and steers; 52-month and older males and steers. The 4-month and 16-month old carcasses were weighed and cooled to normal air temperature with fans. Left legs (internal temperature 52° - 54° F) were removed and placed in a freezer (-2° F) the evening following the date of kill. The legs were held in the freezer below 0° F and shipped under refrigeration in thermoship containers to Colorado State University.

About five months from slaughter date, one-inch steaks were removed from the round at the ventral edge of the pelvis perpendicular to the femur for chemical analysis. Two-inch roasts were cut adjacent to the steaks for cooking and another one-inch steak was cut for duplicate analysis if needed. The

cuts were wrapped separately and stored in the freezer (-2° F). All roasts were placed in a cooler (34° - 36° F) for 48 hours to thaw and warmed to room temperature for 1 1/2 hours before cooking. The roasts were cooked in a 350° F oven to an internal temperature of 160° F or medium rare. Two one-inch cores were taken from leg muscles (Semimembranosus, Quadriceps femoris, Biceps femoris, and Semitendinosus) and allowed to cool for 1 1/2 hours before shearing to estimate tenderness. Shear values were determined by the Warner-Bratzler device which measures pounds of pressure needed to shear.

The taste panel (4-6 persons) scored appearance, juiciness, tenderness (intensity and desirability) and overall acceptability (Figure 1). "Bite size" portions ($1 \times 1 \times 1/3$ inch cores) from the Quadriceps femoris, part of the knuckle, were evaluated. The factors were evaluated on a five point basis, five being the most acceptable, except flavor intensity where five measured the most pronounced.

The exterior fat was trimmed from the muscle samples (Quadriceps femoris) for chemical analysis. Duplicate analysis were made from each muscle in determining percent moisture in the raw product, and percent protein (Kjeldahl method), and fat (Bailey-Walker: pentane extractant) from the dry matter base. Fatty acid composition of the adipose tissue was determined by gas chromatography on samples from 40-month old reindeer males and compared with analysis of 2-year old beef bulls.

Figure 1 - Meat Cooking Record - grading chart for cooked meat*

FACTOR	5	4	3	2	1
Appearance Desirability	Desirable	Moderately desirable	Slightly desirable	Slightly undesirable	Undesirable
Juiciness Intensity	Juicy	Moderately juicy	Slightly juicy	Slightly dry	Dry
Tenderness Intensity	Tender	Moderately tender	Slightly tender	Slightly tough	Tough
Flavor Intensity	Pronounced	Moderately pronounced	Slightly pronounced	Noticeable	Faint
Flavor Desirability	Desirable	Moderately desirable	Slightly desirable	Slightly undesirable	Undesirable
Overall Acceptability	Excellent	Good	Medium	Fair	Poor

*Describe any abnormalities that affect any of the grade factors.

RESULTS AND DISCUSSION

WEIGHTS

The average live weight of 4-month old males was 92 pounds. The average weight of 16-month old males was 180 pounds, steers 172 pounds, and females 148 pounds. Fawn carcass yields averaged 50% and yearlings 49%. The average live weight of 40-month old males was 280 pounds, steers 240 pounds.

FAT COVER

The carcass fat cover at the measure point on 4-month old males was less than .05 inch and on 16-month, slightly over .1 inch. Forty month old steers had an average measure of .24 inch and 40-month old males .5 inch. Fifty-two month old and over steers averaged .3 inch and males over .5 inch.

The carcass fat cover was thickest over the hip bones and became thinner toward the fore part and sides.

MECHANICAL SHEAR

Shear values ranged from 3.25 pounds pressure for the Semitendinosus, eye of the round, of a 4-month old male to 35.5 pounds pressure for the Biceps femoris of a 16-month old female. The eye of the round was more tender than the other leg muscles. Roast from the eye of the round and the Quadriceps femoris from 16-month old reindeer steers were more tender than broiled steaks (Semitendinosus) from 18-month old fed beef.¹

The average shear values are shown in Table 1. Some Quadriceps femoris shear values were compared. The 4-month old and 40-month old males had an average shear value of 12.2, the 16-month old males 14.25, and the 40-month old steer 14.43. In the 16-month old group the females had a high shear value of 19.35. In most comparisons, less pounds of shear force were needed to shear identical samples from males than from steers in the same age group.

TASTE PANEL

The taste panel rated the 4-month old males highest in overall acceptability with an average of 4.1. The 40-month old steers followed with a 3.65 rating and the 16-month old males were third with an average of 3.4. Flavor intensity had a

1. Shear values were given in USDA Technical Bulletin No. T-115.

Table 1 - Average Shear Values²

<u>Age-in</u> <u>Months</u>	<u>Sex</u>	<u>Quadriceps</u> <u>femoris</u>	<u>Biceps</u> <u>femoris</u>	<u>Semi-</u> <u>membranosus</u>	<u>Semi-</u> <u>tendinosus</u>
4	Male	12.17	18.41	16.75	3.87
16	Male	14.25	17.65	23.21	8.00
16	Steer	15.45	24.28	25.33	11.61
16	Female	19.35	26.54	20.04	14.80
40	Male	12.20	23.47	21.54	8.34
40	Steer	14.43	24.70	19.15	10.28
52+	Male	14.00	26.25	23.25	9.25
52+	Steer	20.25	27.25	29.00	16.56

2. Expressed in pounds, the greater the number of pounds the less tender the cooked sample.

TASTE PANEL continued:

definite influence on the acceptability rating (Table 2). The taste panel's scores for tenderness paralleled the mechanical shear values. The overall acceptability evaluation appeared to parallel flavor desirability.

This study shows variation in tenderness within the same age and sex groups but did not attempt to find the reason for the differences within the groups or between the groups.

CHEMICAL ANALYSIS

Sex did not appear to affect the percent of intramuscular moisture, fat, ash, and protein in the 16-month age group. All age average percent of intramuscular moisture was 75.8% and fat

Table 2 - Taste Panel Evaluation Averages - Quadriceps femoris

Age in Months	Sex	Appearance	Juiciness	Tenderness	Flavor Intensity	Flavor Desirability	Overall Acceptability
4	Male	4.29	2.70	4.70	2.11	4.50	4.05
16	Male	3.96	2.38	3.61	2.84	3.80	3.38
16	Steer	4.04	2.09	3.52	2.95	3.48	3.04
16	Female	4.38	3.23	3.30	3.30	3.44	3.30
40	Male	4.09	2.45	3.52	4.04	2.95	2.76
40	Steer	4.70	2.95	3.45	2.70	4.20	3.65
52+	Male	3.75	2.50	3.00	4.50	2.75	3.00
52+	Steer	4.12	2.12	2.25	4.12	3.00	2.12

CHEMICAL ANALYSIS continued:

3.7%. Fat, protein, and ash varied between age groups (Table 3).

As the reindeer age increases, the percent of intramuscular protein decreases and fat increases.

Table 3 - Percent³ - Protein, Fat, and Ash

	<u>4-mo male</u>	<u>16-mo male</u>	<u>16-mo steer</u>	<u>40-mo male</u>	<u>40-mo steer</u>
Protein	72.85	70.83	70.68	65.26	64.20
Fat	9.15	12.70	12.13	19.50	20.46
Ash	4.79	4.52	5.19	5.45	4.56

3. Determined on moisture free basis.

Further analyses indicated that reindeer fat does not contain short-chain fatty acids with 10, 12, and iso-14 carbon chain groups but contained 16:2 and 19 carbon groups that the beef fat

was lacking. Reindeer contained less 14:1, 15, 20, and iso-18 and more 18 carbon chain fatty acids than beef. Reindeer and beef fatty acids were similar in amounts in the other chain groups. As chain lengths increase, the fats become harder.

SUMMARY

Reindeer of four different age groups, 4, 16, 40, and 52 months and older were used in this quality study. Leg muscles from 38 carcasses were used.

Four-month old fawns had a thin fat cover. Forty-month old males and steers had patchy and excessive fat cover. Fat cover on the 16-month old carcasses was most acceptable. The amount of external or intramuscular fat did not appear to affect tenderness. ~~Of the test panel's overall evaluation~~

Both age and sex affect tenderness, flavor, and overall acceptability. The shear values of fawns were the most tender and the taste panel rated fawns most acceptable. The taste panel rated all samples slightly juicy to slightly dry. The eye of the round was the most tender of the leg muscles. As flavor intensity increased with age, overall acceptability decreased.

Fawn meat was higher in protein and lower in fat than older animals. The percent of intramuscular fat of 40-month

old males was about twice that of 4-month old males. Reindeer intramuscular fat was different from beef in kinds and amounts.

CONCLUSIONS

Handling practices that prevent animal excitement, proper selection of slaughter animals, proper packaging and proper cooling and freezing will prevent waste, deterioration and losses. The selection of younger slaughter animals for carcasses and cuts will improve reindeer acceptability. The beef industry has increased its production and slaughter of younger animals and it appears that the reindeer industry needs to follow this practice.

The application of more advanced techniques and increased amounts of capital will help the reindeer industry become more efficient and will aid in developing domestic and foreign markets. Research is needed to determine methods of maintaining reindeer meat quality.

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